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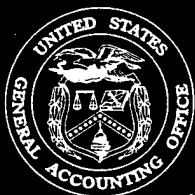
United States General Accounting Office

Report to the Chairman, Subcommittee  
on Defense, Committee on  
Appropriations, House of  
Representatives

June 2000

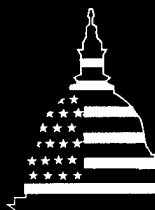
# MISSILE DEFENSE

## Cost Increases Call for Analysis of How Many New Patriot Missiles to Buy



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United States General Accounting Office  
Washington, D.C. 20548

National Security and  
International Affairs Division

B-282712

June 29, 2000

The Honorable Jerry Lewis, Chairman  
Subcommittee on Defense  
Committee on Appropriations  
House of Representatives

Dear Mr. Chairman:

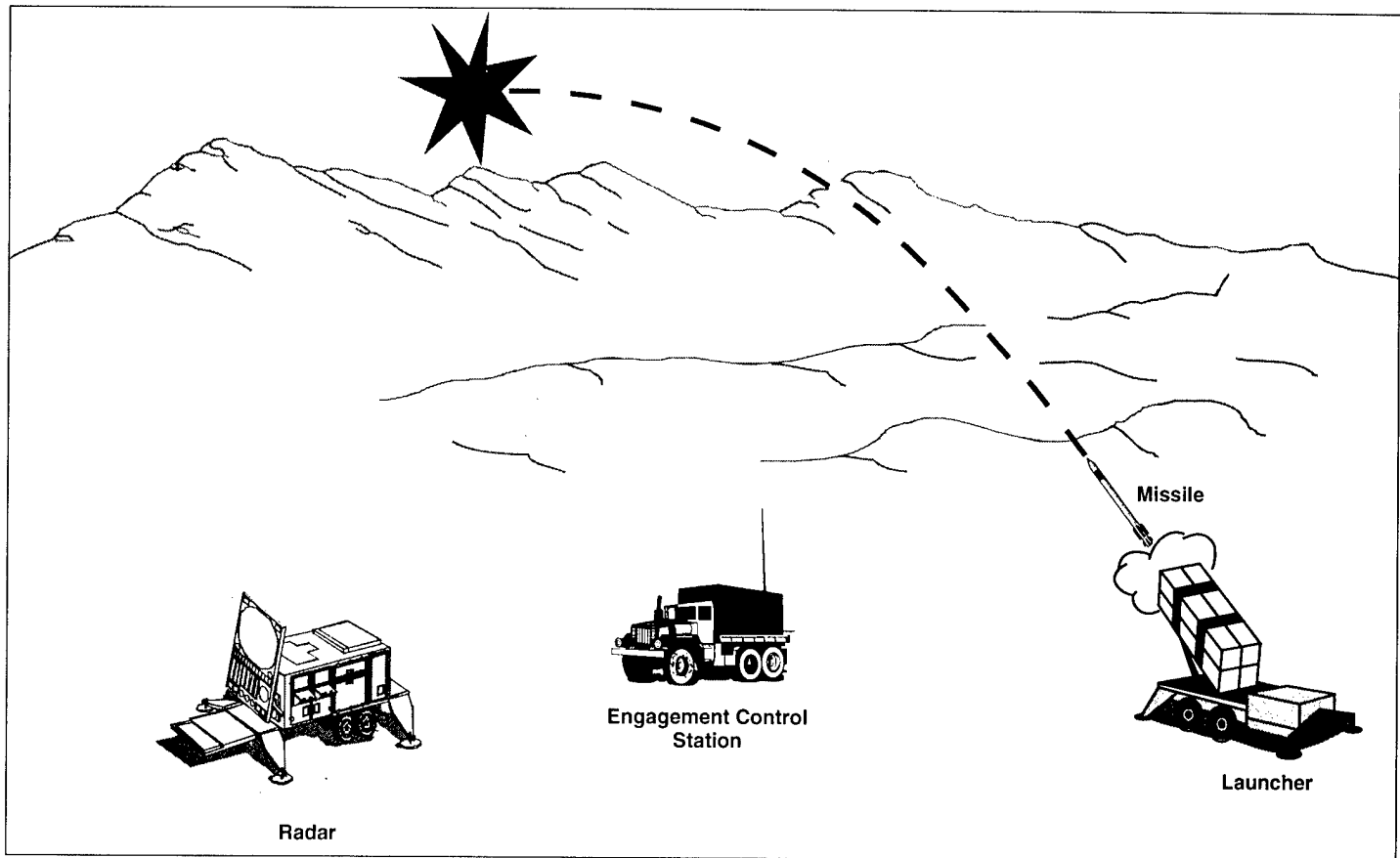
The Patriot Advanced Capability-3 program upgrades the existing Patriot air defense system, which is designed to defend ground combat forces and other assets against an enemy's tactical ballistic missiles,<sup>1</sup> cruise missiles,<sup>2</sup> and other threats such as airplanes and helicopters. Because of the Committee's concerns about cost increases in the Patriot Advanced Capability-3 program, you asked us to address the following questions: (1) How much have costs increased and what are the reasons for those increases? (2) Are additional cost increases expected? (3) What is being done to control costs? and (4) Will the Army's requirements be met by planned missile procurements?

The Patriot system has four basic components: (1) a ground-based radar to detect and track targets and to communicate with the interceptor missile; (2) an engagement control station to provide command, control, and communications; (3) a launcher; and (4) interceptor missiles. (See fig.1.)

<sup>1</sup> Tactical ballistic missiles have ranges varying from 6 to 1,240 miles.

<sup>2</sup> A cruise missile is an unmanned, armed aircraft that can be launched from another aircraft, ship, submarine, or ground-based launcher to attack ships or ground-based targets.

Figure 1: Patriot Missile System



Source: Department of Defense.

The Patriot Advanced Capability-3 program is designed to enhance the Patriot radar's ability to detect and identify targets and improve its performance against low-altitude targets; increase system computer capabilities; improve communications; increase the number of missiles in each launcher; and incorporate a new hit-to-kill missile designed to physically collide with and destroy the target.<sup>3</sup> These improvements are expected to increase the area a Patriot system can defend; improve the potential for destroying higher performance targets; and enhance

<sup>3</sup> This hit-to-kill method of destroying targets is considered more effective than previous methods. The earlier versions of the Patriot missile destroyed their targets by detonating near the target and propelling metal fragments toward it.

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performance against targets carrying nuclear, biological, or chemical warheads.

The President's budget submission for fiscal year 2001 contains a \$446-million request for the Patriot Advanced Capability-3 program. Of this amount, \$81 million is for research, development, test, and evaluation, and \$365 million is for procurement.

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## Results in Brief

Estimated costs of the Patriot Advanced Capability-3 program increased from about \$3.9 billion in 1994 (at the beginning of engineering and manufacturing development)<sup>4</sup> to about \$6.9 billion in March 2000—a 77-percent cost increase. At the same time, the number of missiles to be procured decreased from 1,200 to 1,012. Missile development costs accounted for about \$775 million of the cost increase, and missile procurement costs accounted for about \$2.2 billion. A major reason for the development cost increase was that the original cost estimate did not recognize the level of effort and difficulty associated with developing and producing a hit-to-kill missile compared with those of previous missiles. Missile procurement costs increased primarily because the procurement period was extended by 7 years. Missile procurement was originally scheduled for the 6-year period from 1997 through 2002; the current procurement schedule covers the 13-year period from 1998 through 2010.

Costs are likely to increase further for several reasons. First, the Department of Defense has already recognized that contractor costs for missile development could exceed the contractor's estimate by \$26 million. Second, because the Department's Director for Operational Test and Evaluation was concerned about the adequacy of the testing, the Department is considering additional tests. Costs for the additional test program, which may involve as many as 12 to 15 tests, have not been estimated, but the Patriot Project Office roughly estimated four tests could cost an additional \$88 million. Third, Department officials estimate that costs could increase between \$72 million and \$100 million because of risks and potential schedule delays associated with completing missile development.

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<sup>4</sup> Engineering and manufacturing development is the phase before production and is intended to translate the system concept into a producible system that meets requirements.

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The Department has begun to implement a number of program changes to control costs, and other changes are being studied. Initial efforts involving six missile hardware changes have been implemented or planned. Independent cost estimators have projected savings of \$140 million to \$216 million from these changes and have already factored them into the current procurement cost estimate. Other measures being studied include additional hardware changes and new contracting strategies. As of March 2000, the Department had not made a final decision on additional cost control measures.

There is a gap between the Army's stated requirements and the Department's planned missile procurements. The Army states that 2,200 Patriot Advanced Capability-3 missiles are required to comply with the national security strategy of winning two nearly simultaneous major wars. Because of its concerns about program affordability, the Department never planned to buy all 2,200 missiles; it originally planned to buy 1,200 missiles, and in light of cost increases, it now plans to procure 1,012. Army officials told us that having fewer than 2,200 missiles would force the Army to defend forces and critical assets with less capable missiles. The Department could choose to buy more missiles to close the gap. If further cost increases occur, it could also decide to buy fewer missiles (thereby widening the gap), extend the procurement period, or spend more to maintain the current plan. No detailed analyses have been made of the costs, benefits for defending U.S. forces and assets, or implications of any of these alternatives. Without such analyses, decisionmakers in the Department and the Congress are not in the best position to decide how many missiles to buy.

This report contains a recommendation that the Secretary of Defense perform detailed analyses and report to the Congress on the costs, benefits, and implications of procuring alternative quantities of upgraded Patriot missiles. The Department generally agreed with our recommendation to provide needed information to the Congress but did not agree that it is necessary to do so in a separate report.

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## Background

The Patriot and the Navy Area ballistic missile defense systems are expected to provide the lower tier of defense in an overall missile defense strategy, which includes the Army's Theater High Altitude Area Defense and Navy Theater Wide systems.<sup>5</sup> These latter systems are designed to intercept targets at much higher altitudes (above the atmosphere) than the Patriot missile.

Engineering and manufacturing development of the Patriot Advanced Capability-3 (PAC-3) missile was approved in May 1994. The original schedule called for initial fielding of the missile in 1998 and missile procurement through 2002. Several delays have occurred since that time. As of March 2000, initial fielding of the PAC-3 missile was planned for 2001, and missile procurement was planned through 2010.

With the exception of the missile, all PAC-3 components are upgrades to existing Patriot components. The PAC-3 missile is based on the Extended Range Interceptor Technology program, in which the Department of Defense (DOD) explored the feasibility of developing a hit-to-kill missile. Under this program, the extended range missile was developed in a laboratory environment, prototype missiles were fabricated, and the missiles successfully intercepted three of four test targets.

The Ballistic Missile Defense Organization, a DOD agency responsible for missile defense programs, provides overall management of the PAC-3 program, including its funding. The Army's Program Executive Office for Air and Missile Defense and the Patriot Project Office provide day-to-day management of the program.

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## PAC-3 Missile Program Costs Increased Significantly

Estimated costs of the PAC-3 program increased from about \$3.9 billion in 1994, at the beginning of engineering and manufacturing development, to \$6.9 billion as of March 2000—a 77-percent increase.<sup>6</sup> At the same time, the

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<sup>5</sup> *Ballistic Missile Defense: Improvements Needed in Navy Area Acquisition Planning* (GAO/NSIAD-98-34, Nov. 14, 1997).

<sup>6</sup> The estimate excludes the costs for Extended Range Interceptor Technology efforts and for operating the system after deployment. Costs in this report are expressed in then-year dollars (adjusted for expected inflation).

number of missiles to be procured decreased from 1,200 to 1,012.<sup>7</sup> About \$775 million of the cost increase was for missile development, and about \$2.2 billion was for missile procurement. These increases resulted from a significant cost underestimation, development problems, test program delays, and an extended missile procurement period.

## Costs Were Underestimated

DOD underestimated the costs of developing and producing the PAC-3 missile. DOD had proven the technical feasibility of a hit-to-kill missile under the Extended Range Interceptor Technology program. However, converting the technology to a producible missile that met all tactical requirements and could be used with the Patriot system was a greater challenge than DOD, the Army, or the contractor anticipated. The costs were greatly underestimated because (1) DOD's estimate did not account for the additional level of effort and difficulty in developing a hit-to-kill missile system; (2) the Army and the contractor, Lockheed Martin Missile and Fire Control, were overly optimistic about the development effort; and (3) Army and contractor officials greatly underestimated software requirements.

## Underestimated Effort and Difficulty

Cost estimators in the Office of the Secretary of Defense told us that, because they had very little experience in estimating costs for hit-to-kill missile systems, they did not recognize the much greater level of effort and difficulty associated with developing, testing, and producing a hit-to-kill missile compared with those of previous missiles. DOD estimators said they used the best data available. They relied in part on the actual costs incurred by the Extended Range Interceptor Technology program as the basis for estimating the PAC-3 cost baseline. They verified the reasonableness of the estimate using standard cost estimating tools such as cost history and cost estimating relationships developed for missile systems other than the hit-to-kill. However, the Extended Range Interceptor Technology cost data did not consider (1) the cost and effort required to integrate the system with other Patriot components and (2) the cost of designing and producing a missile to meet tactical requirements

<sup>7</sup> Planned PAC-3 upgraded fire units also decreased from 54 to 36, making another \$172 million available for missile procurement. The PAC-3 fire unit has three main components: the ground radar set, the engagement control station, and eight missile launchers.

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such as operating in adverse weather conditions, in the presence of enemy electronic countermeasures,<sup>8</sup> and in a nuclear environment.

### Overly Optimistic Estimates of the Development Effort

The Army and the contractor were overly optimistic about the effort, processes, and time required for an effective development program. Missile contractor officials said that they originally informed the Army that development would cost about \$890 million, but after negotiations, they agreed to a cost-plus-incentive fee development contract of \$515 million. According to contractor officials, their optimism that development could be done at the lower price was based on (1) projecting cost reductions and eliminating management reserves (contingency funds); (2) agreeing with the Army to eliminate selected tests, some reporting requirements, and many government standards and specifications; and (3) simplifying the method for managing the contract.<sup>9</sup> However, within about a year, both the Army and the contractor realized that they had eliminated needed tests and other risk-reduction measures. As a result, the Army added two additional flight tests, additional ground tests, and 10 additional months of development time to the program. Contractor officials estimate that more than \$200 million in effort was added to the contract, an amount that had been included in their original estimate of \$890 million but eliminated during contract negotiations.

### Underestimated Software Development Effort

The cost of developing missile system software was significantly higher than estimated. DOD and contractor officials told us that they did not anticipate the amount of software required for the program or the difficulty of integrating the PAC-3 missile with the Patriot system. An Army official estimated that software development required twice as much effort as planned. In addition, DOD's independent estimators noted that software maintenance activities are now more extensive than previously estimated.

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<sup>8</sup> Countermeasures refer to the enemy's use of devices and techniques to impair the ballistic missile defense system's operational effectiveness.

<sup>9</sup> An integrated product team approach was used. It was expected to reduce costs by fostering more extensive government-contractor interaction on management issues rather than relying on governmental review after decisions had already been made.



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## Unanticipated Development Problems

The missile contractor attributed \$101 million in cost increases to first-time manufacturing problems, difficulties in getting the guidance system to function with the rest of the missile, and seeker<sup>10</sup> development problems. For example, producing the initial missiles took longer than expected because some sub-systems did not fit together properly, some did not pass electrical tests the first time, and others did not pass missile environmental tests.<sup>11</sup> In addition, the seeker manufacturer tried to cut costs by eliminating environmental tests of components and sub-assemblies and conducting the tests only at the assembly level. However, during early testing, 75 percent of the seekers failed, and the manufacturer incurred extra costs to disassemble the seekers, test components and sub-assemblies to identify faulty ones, and rebuild the seekers.

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## Intercept Flight Test Program Delays and Cancellation

In addition to the delays caused by developmental problems, delays and a cancellation in the intercept flight test program extended the development program and thereby increased development costs. The cost impact of these delays and cancellation is included in the overall cost but has not been estimated for each test. However, DOD's cost estimators believe that each month of development delay costs about \$10 million. Details of the test delays and cancellation are in table 1.

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<sup>10</sup> A seeker is an on-board system that acquires the target and provides guidance accuracy.

<sup>11</sup> Environmental tests subject components or sub-assemblies to temperature extremes, vibration, and shock.

**Table 1: Extent of and Reasons for PAC-3 Flight Test Delays and Cancellation**

Type of test	Months of delay	Reasons for delay/cancellation
Seeker characterization flight test	3	Target failure and range safety concerns due to high winds at the test range.
Development test 3	4.5	Drought conditions at test range, <sup>a</sup> target failure, and technical problems with missile seeker.
Development test 4	Canceled <sup>b</sup>	To avoid a possible test failure because successfully intercepting the target may have required software not yet in the PAC-3 missile.
Development test 5	3.5	Delays in earlier tests and range safety concerns due to high winds at the test range.
Development tests 6 and 7	2 <sup>c</sup>	Delays in software development.

<sup>a</sup>Missile flight tests were prohibited for a period due to potential fire hazards caused by drought conditions at the test range.

<sup>b</sup>The test was initially delayed but later canceled with the intention of incorporating the objectives into other tests.

<sup>c</sup>Current plans call for conducting development test 7 before development test 6 in July and September 2000, respectively. The net slippage in the two tests is expected to be 2 months.

Source: Our analysis of DOD data.

## Extension of Missile Procurement

According to DOD and contractor officials, the extension of the missile procurement period by 7 years is the principal reason for the \$2.2-billion increase in the procurement cost estimate. Extending the procurement schedule while buying the same number or fewer missiles increases program costs because the fixed costs of production are incurred over a longer period, missiles may not be produced at the most economical production rate, and inflation generally causes missile costs to increase in later years.

In 1994, at the beginning of engineering and manufacturing development, DOD planned to fund the procurement of 1,200 PAC-3 missiles during the 6-year period from 1997 through 2002—an average of 200 missiles per year. However, according to the fiscal year 2001 budget request, DOD plans to

fund the procurement of 1,012 missiles over the 13-year period from 1998<sup>12</sup> through 2010—an average of about 37 missiles per year for the first 8 years and 144 missiles per year for the last 5 years. Table 2 shows the number of PAC-3 missiles to be procured each year as planned in the original 1994 estimate and in the 2001 budget request.

**Table 2: Planned Number of Missiles to Be Procured Annually**

Fiscal year	Original program 1994	President's budget request for fiscal year 2001
1997	90	
1998	215	20
1999	240	0
2000	250	32
2001	250	40
2002	155	28
2003		44
2004		76
2005		52
2006		144
2007		144
2008		144
2009		144
2010		144
<b>Total</b>	<b>1,200</b>	<b>1,012</b>

Source: DOD.

## Missile Development Costs Are Likely to Increase Further

Missile development costs are likely to increase further for several reasons. First, on the basis of contractor cost data, DOD budget documents estimate that the price for completing the missile development (cost-plus-incentive-fee) contract could be about \$26 million more than the current estimate.

<sup>12</sup> Initial production was funded with the fiscal year 1998 appropriation, but actual production did not begin until fiscal year 2000.

Second, additional tests are being considered but have not yet been budgeted. DOD testing officials believe that as many as 12 to 15 additional tests may be required because, in light of missile changes and possible test deferments, current and planned tests would not be adequate to assess the system's suitability and effectiveness—a requirement for beginning full-rate production. In response to this concern, Project Office and Ballistic Missile Defense Organization officials are considering adding four tests in 2002-04—roughly estimated to cost \$88 million. In addition, they said that up to seven additional tests are already planned for a later phase but that the costs of these tests are not included in the current estimate.

Third, missile costs are likely to increase because of risks and potential schedule delays associated with completing missile development. Specifically:

- In February 1999, the contractor recommended establishing a \$40-million management reserve—\$30 million for the possibility of a flight test failure and \$10 million for other risks.
- In May 1999, a DOD review team also recommended establishing a \$40-million management reserve, noting that the development schedule makes no provision for a flight test failure, provides no margin for learning or mistakes, and does not consider test range availability. However, the reserve was not included in the current estimate.
- DOD's Cost Analysis Improvement Group informed DOD decisionmakers in October 1999 that schedule risk could easily add \$62 million to the cost estimate because (1) significant first-time integration activities remain to be accomplished (for example, the final version of the software must be completed and integrated into the missile); (2) programs in the missile defense area have historically had difficulty in meeting ambitious flight test schedules; and (3) the schedule does not account for possible flight test failures.
- Risk assessments performed by the Army and the Ballistic Missile Defense Organization in November 1999 disclosed that completing the missile development program could cost as much as \$72 million to \$100 million more than estimated. The assessments included potential costs for the remaining technical risks, a flight test failure, multiple launch attempts, and software development and integration risk.

Fourth, the remaining flight tests will become progressively more challenging—increasing the possibility of further delays and cost increases. The first two flight intercept tests were conducted against low-flying, non-maneuvering, relatively slow targets. The target for the third intercept

made some maneuvers at a high altitude. However, future flight tests will add complexity, including cold- and hot-conditioned PAC-3 missiles,<sup>13</sup> highly maneuvering and high-velocity targets, targets protected by electronic countermeasures, and targets designed to make detection difficult. Officials from DOD's Cost Analysis Improvement Group, the Office of the Director of Operational Test and Evaluation, and the Ballistic Missile Defense Organization acknowledge that future flights are designed to demonstrate PAC-3's capabilities under more challenging conditions than previously tested.

In response to our questions regarding potential cost increases, the Patriot project manager informed us that in the event of a flight test failure, the Army now has the missile hardware for an additional flight test because a previous test was canceled. However, he acknowledged that DOD has not budgeted for the cost of another flight test or for the potential 3- to 6-month delay that could be associated with a flight test failure.

### Some Cost Containment Measures Are Being Implemented, Others Are Being Studied

To control development and procurement costs, DOD and contractor officials have begun to implement various program changes and are examining other cost-cutting measures. For example, in late 1998 and early 1999, a study team appointed by the Director of the Ballistic Missile Defense Organization focused on the causes of cost growth and recommended improvements to control development costs. Among other things, the team recommended that (1) the PAC-3 program establish a realistic cost and schedule baseline and (2) the schedule take into consideration the possibility of a flight test failure. In response, new cost and schedule baselines were developed, but as discussed earlier, the schedule revisions did not provide for a flight test failure. At the same time, another study team appointed by the Director and the Army recommended that the Army seek multiyear procurement authority<sup>14</sup> at full-rate

<sup>13</sup> Missiles that are subjected to extremely cold temperatures (-25° F.) and extremely hot temperatures (131° F.) before firing.

<sup>14</sup> Multiyear procurement is a method for acquiring up to 5 years' requirements with a single contract. This method usually provides cost savings through more efficient subcontracting and component and material purchases.

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production, pursue an innovative contracting strategy,<sup>15</sup> and actively seek foreign military sales. All of these recommendations, which are designed to lower unit costs of producing the missiles, are still being considered.

In addition, in 1998 and 1999, the Army and the missile contractor identified six hardware changes that could reduce procurement costs. The six changes, which are being implemented or planned, include design and manufacturing modifications such as reducing the number of component parts, making components easier to assemble, removing redundant parts, and making some components from less costly material. Independent cost estimators—the Army's Cost and Economic Analysis Center and DOD's Cost Analysis Improvement Group—estimated that the potential cost savings from these hardware changes would range between \$140 million and \$216 million. The estimators have already factored these savings into the current program production cost estimate.

Also, in early 2000 a cost review team appointed by the Director of the Ballistic Missile Defense Organization concluded that about 500 more missiles could be bought without an overall program cost increase by incorporating additional cost reduction actions. These actions include identifying alternative subcontractors for selected components, streamlining test processes, using more commercial parts, and selling PAC-3 missiles to foreign countries. Ballistic Missile Defense Organization officials informed us that the review results are not complete, are currently being evaluated for cost accuracy and risk, and are only proposals that do not represent an official position or a decision to implement. However, Patriot project officials are devising a plan to implement at least some of these initiatives. Providing an independent perspective on the cost review team's findings, officials from the Cost Analysis Improvement Group and the Army's Cost and Economic Analysis Center told us that savings of the projected magnitude are extremely doubtful because some savings have already been included in the current cost estimate and other savings may never be realized.

DOD officials are also examining several other cost containment measures, including deferral of the (1) demonstration of the PAC-3 missile's capability to intercept airplanes and helicopters, (2) incorporation of the software

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<sup>15</sup> The proposed contracting strategy—fixed-price incentive with successive targets—uses potential savings and an award fee to provide the contractor with incentives to reduce production costs.

necessary to operate in the presence of electronic countermeasures, and (3) demonstration of the missile's capability to operate against electronic countermeasures. Ballistic Missile Defense Organization and Army officials informed us that these tasks would be deferred only if necessary in order for the PAC-3 development effort to stay within approved funding levels. However, if these tasks are deferred, the PAC-3's effectiveness would not be tested against all its requirements before September 2001, the scheduled date for a full-rate production decision.

## The Army Says It Requires Twice as Many Missiles as DOD Plans to Procure

There is a gap between the Army's stated requirements and DOD's plans to procure the missiles. According to Army operations and plans officials, DOD's planned missile procurement is less than half the number required to comply with the national military strategy of winning two nearly simultaneous major wars. No detailed analyses have been conducted, however, of the costs, benefits, and implications of procuring additional missiles to close this gap or, if additional cost increases occur, of buying fewer missiles, extending the procurement period, or spending more to maintain current procurement levels.

## Gap Between Army Requirements and Planned Missile Procurements

The Army determined in 1993 that 2,200 PAC-3 missiles were required to support the national military strategy. More recent Army studies, conducted in 1997 and 1998, showed that 2,400 to 2,600 PAC-3 missiles were needed. Army operations and plans officials told us that the Army did not change the official requirement from 2,200 because it wanted to maintain a consistent requirement. To establish the required number of PAC-3 missiles, the Army considers (1) the operational objectives of the combatant commands,<sup>16</sup> (2) logistics capabilities, and (3) the residual stock of missiles required at the conclusion of a war.

Over time, planned procurement has reflected the estimated maximum number of missiles that could be afforded given PAC-3's planned funding. In fiscal year 1994, when the system was approved for engineering and manufacturing development, DOD expressed the intention to buy 1,200 missiles by 2002. However, as program costs increased, procurement quantities were reduced and the period of procurement was extended. In

<sup>16</sup> Combatant commands are responsible for operational control of military forces in specific regions of the world.

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the fiscal year 2000 budget, DOD indicated the intention to buy 560 missiles by 2006; in the 2001 budget, it announced plans to buy 1,012 missiles by 2010—of which 436 would be purchased by 2006.

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### Army Says Lower Procurements Would Degrade Defensive Capability

In 1994, the Director of Requirements, Office of the Army Deputy Chief of Staff for Operations and Plans, stated that procurement of fewer than 2,200 PAC-3 missiles would increase the operational risk to deployed forces. The Director also stated that the Army would not have an adequate number of missiles to fight two major theater wars if DOD could afford only 1,100 or fewer missiles.

In March 2000, Army operations and plans officials told us that procurement of fewer than 2,200 missiles (1) would degrade the Army's capability to defend U.S. forces and critical assets and (2) would make the Army rely more heavily on earlier versions of the Patriot missile that are less effective against nuclear, biological, or chemical warheads. They also stated that the extension of the production program forces the Army to rely on less capable Patriot missiles for longer than planned.

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### Detailed Analyses of Alternative Procurement Quantities Have Not Been Conducted

Neither the Office of the Secretary of Defense nor the Army has done detailed analyses of the costs, the benefits to the Army's capability to defend U.S. forces and critical assets, or the implications of alternative procurement quantities. For example, DOD could choose to buy more missiles to close the gap between the Army's requirements for 2,200 missiles and DOD's plan to procure 1,012 missiles. On the other hand, if further cost increases occur, DOD could also decide to buy fewer missiles (thereby widening the gap), could extend the procurement period, or could spend more to maintain the current plan. Spending more on the PAC-3 program, of course, could be done at the expense of other programs. Without such analyses, decisionmakers in the Department and the Congress are not in the best position to decide how many missiles to buy.

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### Conclusions

Cost growth has been a continuing problem for the PAC-3 program since it entered engineering and manufacturing development in 1994. The cost growth has, in turn, raised program affordability concerns and has led DOD to reduce the number of missiles to be procured and extend the procurement period, despite the expected degradation of defense capability this would cause.



We expect affordability concerns to become even more prominent for several reasons. First, the Army has a clear interest in closing the gap between its stated requirement for 2,200 missiles and DOD's planned procurement of 1,012 missiles. Second, DOD has postponed difficult funding decisions in the short term by deferring most procurement until 2006-10; as a result, the affordability of procuring larger quantities of PAC-3 missiles is likely to become an even greater issue as 2006 approaches. Third, because additional cost increases are likely, higher funding levels would be needed just to maintain procurement at the planned level. Without detailed analyses of the costs, benefits, and implications of procuring alternative quantities of missiles, decisionmakers in DOD and the Congress do not have the necessary information to make a sound decision on how many PAC-3 missiles to buy.

## Recommendations

To help determine how many upgraded Patriot missiles to buy, we recommend that the Secretary of Defense perform detailed analyses and report to the Congress on the expected costs, benefits, and implications of the currently planned and alternative procurement levels. These analyses should, at a minimum, examine expected impacts of (1) buying more missiles, (2) buying fewer missiles to address increased costs, or (3) buying the same number of missiles but extending the procurement period or increasing funding to address increased costs. They should also examine the potential degradation in defense capability resulting from any gaps between alternative procurement levels and the Army's stated requirements.

## Agency Comments and Our Evaluation

In its written comments on a draft of this report, DOD generally agreed that it should provide the Congress with the information necessary to determine the appropriate level of PAC-3 program funding. DOD did not agree that the Secretary should provide a separate report.

DOD stated that the President's budget request and its supporting materials represent the Department's position regarding the most appropriate level of funding for the PAC-3 program; and that it provides supplemental program cost, schedule, and performance information to the Congress in a selected acquisition report at least once annually. DOD also said that it will provide supplemental information about various program alternatives as requested by the congressional defense committees. DOD stated its belief that with

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these actions it already fulfills the spirit and substance of the recommendation.

We do not believe that the information DOD cited above would satisfy the intent of our recommendation. Past budget requests and selected acquisition reports do not provide needed information. For example, the fiscal year 2000 budget request and the December 1998 selected acquisition report showed a planned procurement of 560 PAC-3 missiles—a 53-percent reduction from the previous budget requests and selected acquisition reports. However, no information was provided in the documents to address the impact on military capabilities caused by the reduction in the number of missiles to be procured, the trade-offs made in arriving at the lower procurement level, or the benefits that could be derived from additional funding. Similarly, the fiscal year 2001 budget request and the 1999 selected acquisition report again showed a change in planned procurement—this time an increase in the number of missiles to be procured to 1,012—but did not discuss the impacts of that change. Moreover, neither the budget requests nor the selected acquisition reports have addressed the impact on military capabilities caused by (1) procuring substantially fewer missiles than the Army says it requires to comply with the national security strategy and (2) procuring and fielding most of the missiles at a much later time than planned. The original schedule showed procuring 1,200 missiles by 2002 versus current plans to procure 1,012 missiles by 2010, with only 120 missiles to be procured by 2002.

Although DOD could provide supplemental information as requested by the congressional defense committees, producing a separate report would give greater assurance that DOD would provide a timely, complete report to the Congress addressing the cost, benefits, and implications of procuring alternative quantities of PAC-3 missiles.

We have modified our recommendation to further explain the kind of detailed analyses and information that we feel would be useful to decisionmakers. DOD also provided technical comments that we incorporated where appropriate.

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## Scope and Methodology

To address the Chairman's questions, we reviewed DOD, Army, and Ballistic Missile Defense Organization cost estimates and independent, DOD, and contractor cost reviews and assessments. We also discussed cost, schedule, risk, and requirements issues with knowledgeable officials from the Patriot Project Office, the Army, the Ballistic Missile Defense

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Organization, the Office of the Secretary of Defense, the contractor, and user and test communities.

We obtained information on the extent of cost growth and assessed the underlying reasons by comparing the original cost estimate with the current estimate. We identified the reasons for cost growth by reviewing DOD and contractor cost estimates; reviewing independent cost group reports, contract files, and contractor reports; and obtaining the views of key officials from these organizations.

To determine whether additional cost increases are expected and whether budgeted amounts are sufficient, we evaluated current cost estimates and compared them with current budget estimates. We analyzed the PAC-3 cost estimates prepared by contractor, Army, and independent estimators and obtained their views on the potential for additional cost growth.

To evaluate the impact of actions taken or planned to reduce costs, we obtained detailed descriptions of planned cost reduction and cost containment measures. We also obtained DOD studies and evaluations of the proposed measures. We discussed these measures with DOD and contractor officials to determine the validity of the measures and the projected costs and savings from their implementation.

We compared planned procurement quantities with the requirements defined by the Army by obtaining and analyzing the Army's methodology for determining requirements and discussing it with pertinent officials. We also obtained and analyzed missile quantity studies prepared by DOD and discussed these studies with pertinent officials. We discussed quantity shortfalls with the Army user community to identify their impact.

We conducted our work from May 1999 through April 2000 in accordance with generally accepted government auditing standards.

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As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from its issue date. At that time, we will send copies to other interested congressional committees; the Honorable William Cohen, Secretary of Defense; the Honorable Louis Caldera, Secretary of the Army; and the Honorable Jacob Lew, Director, Office of Management and Budget. Copies will also be made to others on request.

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Please contact me at (202) 512-4841 if you or your staff have any questions. Major contributors to this report were Bob Levin, Wayne Gilliam, and Terry Wyatt.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Allen Li". The signature is fluid and cursive, with the first name "Allen" and the last name "Li" clearly distinguishable.

Allen Li  
Associate Director  
Defense Acquisitions Issues

# Comments From the Department of Defense



ACQUISITION AND  
TECHNOLOGY

## OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON  
WASHINGTON DC 20301-3000

07 JUN 2000

Mr. Allen Li  
Associate Director, Defense Acquisitions Issues  
National Security and International Affairs Division  
U.S. General Accounting Office  
Washington, D.C. 20548

Dear Mr. Li:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "MISSILE DEFENSE: Cost Increases Call for Analysis of How Many New Patriot Missiles to Buy," dated May 3, 2000 (GAO Code 707422/OSD Case 1992).

The Department partially concurs with the draft report's recommendation. The draft report states, "to help determine the appropriate level of future funding of the Patriot Advanced Capability-3 program, we recommended that the Secretary of Defense report to the Congress on the costs, benefits, and implications of procuring alternative quantities of missiles" (page 18, GAO Draft Report). The Department agrees it should provide the information necessary to determine the appropriate level of PAC-3 program funding. The Department does not agree that the Secretary of Defense should prepare a separate report to Congress.

The President's Budget request and its supporting materials represent the Department's position as to the most appropriate level of funding for major acquisition programs, including PAC-3. The Department also will, as appropriate, provide supplemental information as requested by the congressional defense committees about various program alternatives as part of the annual process to justify the President's Budget request. As you know, the Department also provides to Congress a Selected Acquisition Report (SAR) at least once each year to report PAC-3 program cost, schedule, and performance information. By these actions, the Department believes it already fulfills the spirit and substance of the GAO's recommendation.

The Department appreciates the opportunity to comment on the draft report. We have separately provided suggested changes for clarification and accuracy.

Sincerely,

George R. Schneider  
Director  
Strategic and Tactical Systems



See page 15.

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